

Claims

WHAT IS CLAIMED IS:

1. A mine door for installation in a passageway of a mine comprising:

5 a leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed,

10 said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on one of said faces of the leaf than on the other of said faces of the leaf,

15 said leaf having an opening therein for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf, and

20 a power-operated closure mounted adjacent said opening and movable between a closed position blocking passage of air through said opening and an open position allowing passage of air.

2. A mine door as set forth in claim 1 installed in the mine such that the higher pressure is on the first face of the leaf so that the leaf opens toward the higher pressure.

3. A mine door as set forth in claim 2 wherein the closure is hinged on the leaf so that the closure opens toward the higher pressure.

4. A mine door as set forth in claim 1 wherein the closure is hinged on the leaf so that the closure opens toward the higher pressure.

5. A mine door as set forth in claim 1 wherein the closure is operated by a power mechanism adapted for opening the leaf after opening the closure.

6. A mine door as set forth in claim 5 wherein the power mechanism includes a single source of pressurized fluid, a first actuator operably connected to the closure and to the single source, and a second actuator operably connected to the leaf and to the single source, the power mechanism being constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.

7. A mine door as set forth in claim 6 wherein the power mechanism further includes parallel fluid supply lines to the first and second actuators adapted for opening the closure and the leaf in sequence.

8. A mine door as set forth in claim 7 wherein the pressurized fluid is air.

9. A mine door as set forth in claim 1 in combination with a door frame adapted for installation in the passageway and adapted for mounting the leaf.

10. A mine door as set forth in claim 9 wherein the door frame is adapted for mounting a second leaf adjacent the first-mentioned leaf, respective faces of the first and second leafs being substantially coplanar when the leafs are in the closed position.

11. A mine door as set forth in claim 1 wherein the leaf includes a man door opening and a man door mounted on the leaf for moving between a closed position for closing the man door opening and an open position for allowing personnel to pass through the man door opening, the closure being spaced from the man door.

12. A mine stopping system installed in a passageway of a mine for closing the passageway, the system comprising:

a wall extending at least partway across the passageway,

a door frame installed in or adjacent the wall to define a doorway to allow passage of machinery,

a door leaf hinged on the door frame for swinging between a closed position in the doorway and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction, the leaf when closed being subject to a differential in air pressure involving higher pressure on one of said faces of the leaf than on the other of said faces,

an opening disposed in at least one of said leaf, wall and door frame for passage of air therethrough to more nearly equalize the pressure on said faces of the leaf and thereby reduce the force required to open or close the leaf, and

a power-operated closure for said at least one opening movable between a closed position blocking passage of air and an open position allowing passage of air.

13. A mine stopping system as set forth in claim 12 wherein the opening is disposed in said leaf.

14. A mine stopping system as set forth in claim 12 wherein the opening is disposed in said wall.

15. A mine stopping system as set forth in claim 12 wherein the leaf is power-operated, the stopping system further comprising a power mechanism including a single source of pressurized fluid for operating said closure and said leaf, said power mechanism adapted for opening the leaf only after the closure is opened.

16. A mine stopping system as set forth in claim 15 wherein the power mechanism further includes a first actuator operably connected to the closure and to the single source, and a second actuator operably connected to the leaf and to the single source, the power mechanism constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.

17. A mine stopping system as set forth in claim 16 wherein the leaf is installed such that the higher pressure is on the first face of the leaf so that the leaf opens toward the higher pressure, and wherein the closure is mounted so that the closure opens toward the higher pressure.

18. A mine stopping system as set forth in claim 17 wherein the power mechanism further includes parallel fluid supply lines to the first and second actuators and a valve movable to an open position for allowing fluid to flow to the first and second actuators in parallel and to cause the closure and the leaf to open in sequence.

19. A mine door unit for installation in a passageway of a mine comprising:

a door frame adapted to be installed in the passageway to define a doorway sized and shaped to allow passage of machinery,

a leaf hinged on the door frame for moving between a closed position for at least partially closing the doorway and an open position to permit passage of machinery through the doorway,

10 a man doorway in the leaf sized and shaped to allow passage of personnel,

a man door mounted on the leaf for closing the man doorway,

15 a pressure relief opening in the leaf and not in the man door, and

a closure mounted on the leaf for moving between a closed position for closing the pressure relief opening and an open position for relieving pressure against the leaf to facilitate opening of the leaf, the closure not being on the man door.

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20. A mine door unit as set forth in claim 19 wherein the closure is power-operated.

21. A mine stopping system forming an airlock space in a mine passageway comprising:

5 a plurality of stoppings mounted in the passageway in spaced apart relation, said stoppings forming an airlock with an airlock space therebetween,

each stopping including a door leaf mounted for moving between open and closed positions,

10 at least one of said stoppings including a pressure relief opening therein and a power-operated closure mounted adjacent the opening for moving between a closed position for closing the pressure relief opening and an open position for relieving air pressure against the leaf to facilitate opening or closing of the leaf.

22. A mine stopping system as set forth in claim 21 wherein the opening is in the leaf of said at least one stopping and the closure is mounted on the leaf.

23. A mine stopping system as set forth in claim 22 wherein the closure and the leaf in said at least one stopping are operated by a power mechanism adapted for opening the leaf after opening the closure.

24. A mine stopping system as set forth in claim 23 wherein the power mechanism includes a single source of pressurized fluid, a first actuator operably connected to the closure and to the single source, and a second actuator operably connected to the leaf and to the single source, the power mechanism constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.